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New records of the diving beetle *Rhantus simulans* Régimbart, 1908 in south-western Australia (Coleoptera, Dytiscidae, Colymbetinae)

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Abstract

New distributional records of the rarely collected diving beetle *Rhantus simulans* Régimbart, 1908, an endemic species of south-western Australia, are presented. We also summarize what is known about its habitat. The occurrence of *R. simulans* indicates a high conservation value of the sampled wetland. For easier identification, we provide photographs of the habitus and male genitalia of *R. simulans* and *R. suturalis* (Macleay, 1825). *Rhantus simulans* is now recorded from 17 localities along the coast of south-western Australia. Furthermore, data on the location of other 31 diving beetle species are provided.

Keywords

Aquatic Coleoptera, endemic species, new records, *Melaleuca* wetlands

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Introduction

The diving beetle subfamily Colymbetinae Erichson, 1837 comprises 11 genera worldwide (Miller and Bergsten 2016; Balke et al. 2017). In Australia, Colymbetinae are represented by the widespread genus *Rhantus* Dejean, 1833 (Balke et al. 2000; Miller and Bergsten 2016; Nilsson and Hájek 2017), with two species (Hendrich et al. 2019). One species, the so called "supertramp" *Rhantus suturalis* (Macleay, 1825) (Fig. 1B) is distributed over almost all of Australia, except the tropical lowlands in the north, and recorded from all states but one. On the other hand, *Rhantus simulans* Régimbart, 1908 (Fig. 1A), is endemic to the south-western corner of Western Australia (Balke et al. 2000; Watts 2002). A key to the adults was provided by Balke et al. (2000), including simple line drawings of the relevant morphological features. The larvae of both Australian *Rhantus* species have been described by Alarie et al. (2009). Here we present new records of *R. simulans* and summarize what is known about its habitat requirements. Furthermore, both Australian species are illustrated with color photographs for a better and faster identification even in the field.

Methods

Material. This study is based on the examination of 159 specimens (137 adults and 22 larvae) of *R. simulans*. Most of the specimens were collected in the past 25 years by L. Hendrich and C.H.S. Watts (Adelaide). Furthermore,

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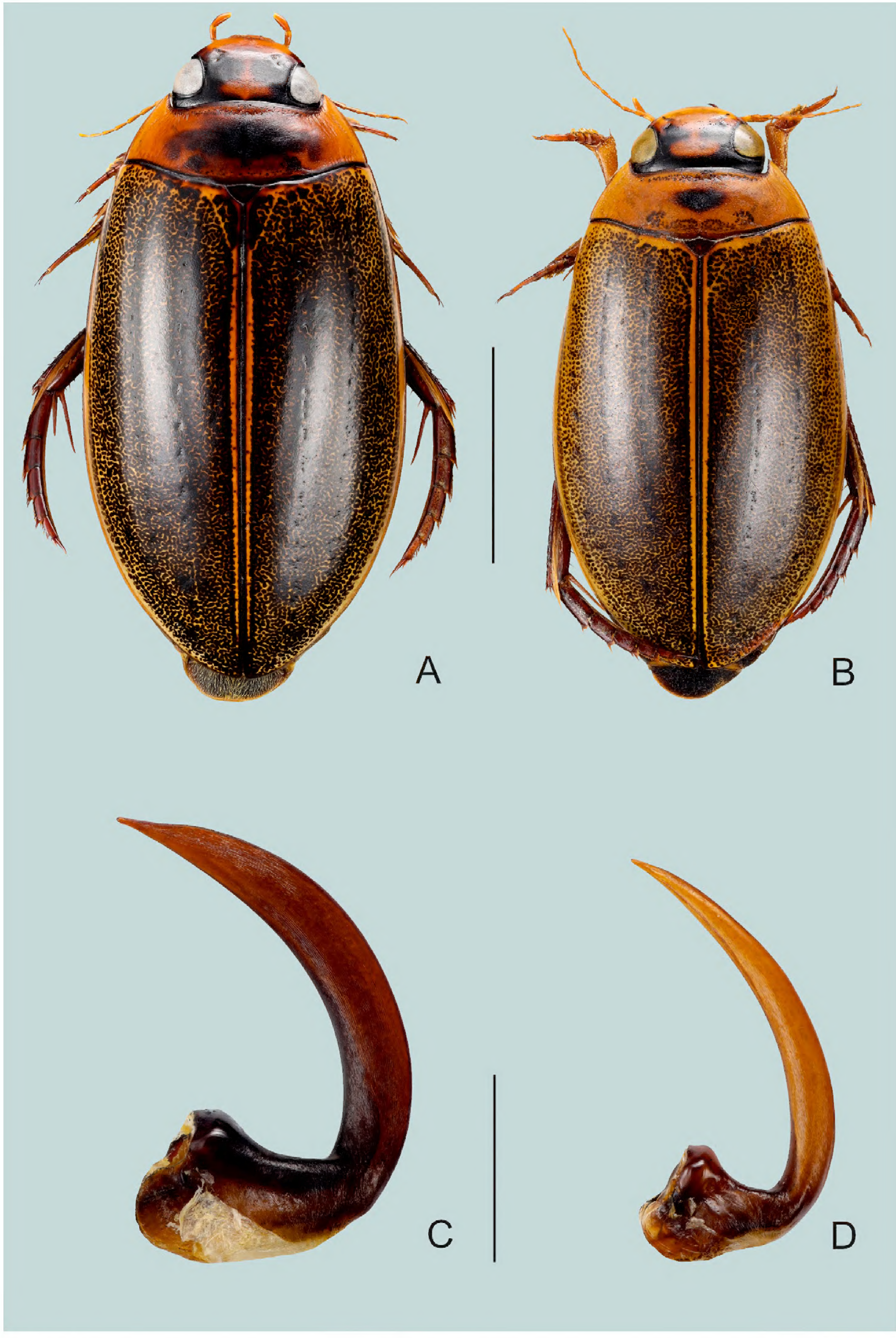

Figure 1. A. Habitus of *Rhantus simulans* from Beeliar Reserve in Perth. **B.** Habitus of *Rhantus suturalis* from the Stirling Range in Western Australia, scale bar = 5 mm **C.** Median lobe of *R. simulans*, lateral view. **D.** Median lobe of *R. suturalis*, lateral view, scale bar = 1 mm.

the first author has studied all available specimens stored in relevant Australian museums and in the reference collection of the Department of Parks and Wildlife, Kensington, Australia.

Photos and illustrations. Images were taken with a Canon EOS R camera fitted with a 10× Mitutoyo objective (genitalia), or a MPE 65 macro lens (habitus), attached to a Stackmaster (Stonemaster: https://www.stonemaster-onlineshop.de/) macro rail. Illumination was with three LED segments SN-1 from Stonemaster. Image stacks were generated using the Stackmaster macro rail, and images were then assembled with Helicon Focus 4.77TM software.

Coordinates. These are given in decimal notation unless cited verbatim from labels. Besides various Australian road maps, we also used Google Earth (http://earth.google.com) to locate several localities. Our map is based on "Microsoft Encarta World-Atlas 2000".

Codens.

AUS: Australian Museum Sydney, New South Wales, Australia
CFP: Collection Fernando Pederzani, Ravenna, Italy
CLH: Collection Lars Hendrich, Berlin, Germany; property of the NMW
CYA: Collection Yves Alarie, Laurentian University, Sudbury, Ontario, Canada
DPAW: Department of Parks & Wildlife, Kensington, Australia
SAMA: South Australian Museum, Adelaide, South Australia, Australia
WAM: Western Australian Museum, Perth, Western Australia, Australia
ZSM: Zoologische Staatssammlung München, Munich, Germany

Results

Rhantus simulans Régimbart, 1908

Rhantus simulans Régimbart 1908 (type locality: Albany): 313; Watts 1978: 114, 1985: 25; Balke 1993: 63; Balke et al. 2000: 224.
Rhantus impar Guignot 1956 (type locality: Rockingham): 491; Watts 1985: 25; Balke 1993: 63.

Material studied.

Published records (8 localities). AUSTRALIA – **Western Australia** • 21 km west of Albany, near Torbay (loc. WA 40); 35°01′S, 117°39′E; alt. 10 m; 28.XI.1996; Hendrich leg.; 2 sex indet., CLH • D'Entrecasteaux National Park, 5 km south of Northcliffe; 35°01′S, 117°39′E; alt. 20 m; 3.I.2000; Hendrich leg.; 2 sex indet., CLH • D'Entrecasteaux National Park, 20 km south of Northcliffe; 34°48′S, 116°04′E; alt. 20 m; 5.I.2000; Hendrich leg.; 2 larvae (LA III), CYA • D'Entrecasteaux National Park, 15 km south of Northcliffe; 34°48′S, 116°04′E; alt. 15 m; 4.I.2000; Hendrich leg.; 24 sex indet., CLH, SAMA, WAM, ZSM • 10 km south of Northcliffe; 3.XII.1998; F. Pederzani leg.; 2 sex indet., CFP • Lake Muir Nature Reserve, Byenup Lagoon; 34°30′S, 116°44′E; alt. 183 m; 6.I.2000; Hendrich leg.; 15 sex indet., CLH, WAM • Lake Muir Nature Reserve, Byenup Lagoon; 34°30′S, 116°44′E; 183 m; 21.IX.2000; C.H.S.Watts leg.; 1 sex indet., SAMA. Old records from Albany (type locality), Rockingham (type locality of *R. impar*) and Swan River near Perth (see Balke et al. 2000).

New records (12 localities). AUSTRALIA – **Western Australia** • Denmark; 34°57′S, 117°21′E; 24.I.1997; McMillan leg.; at light; 1 sex indet., WAM • Midlands, Gingin, Gingin Brook Wetland Board Walk (Loc. WA 33/197); 31°20′S, 115°54′E; 11.IX.2002; Hendrich leg.; 1 sex indet., CLH • 70 km south of Lancelin; 31°37′S, 115°42′E; 6.I.1991; M.S. & B.J. Moulds leg.; 1 sex indet., AUS • Manjimup, Bannister Road; 34°26′S, 116°08′E; 16.X.2010; Pennifold leg., QC092302, WAR16, Southwest Forest Monitoring; 1 sex indet., DPAW • Lake Pleasant Nature View; 34°49′S, 118°10′E; 17.IX.2000; C.H.S. Watts leg.; 2 sex indet. SAMA • Coorinup Swamp; 34°29′S, 116°48′E; 21.IX.2000; C.H.S. Watts leg.; 1 sex indet. SAMA • South Coast Hwy 10 km W Albany, Marbelup Brook (WA 161); 34°59′S, 117°43′E; alt. 14 m; 3.I.2007; L. & E. Hendrich; 4 sex indet., CLH, ZSM • D'Entrecasteaux National Park, 15 km south of Northcliffe (WA 163); 34°48′S, 116°04′E; alt. 25 m; 5.I.2007; L. & E. Hendrich leg., large pool without any vegetation; 20 sex indet., ZSM • D'Entrecasteaux National Park, 11 km S Northcliffe (WA 162); 34°44′S, 116°05′E; alt. 77 m; 4.I.2007; L. & E. Hendrich leg., *Melaleuca* swamp; 8 sex indet., CLH, ZSM • D'Entrecasteaux National Park, 5 km NE Northcliffe, road to Quinninup (WA 164); 34°34′S, 116°08′E; alt. 120 m; 5.I.2007; L. & E. Hendrich leg.; 3 sex indet., ZSM • Beeliar Recreation Park, Paperbark Swamp at Branch Crescent (loc. 2); 32°08′S, 115°50′E; alt. 21 m; 10–20.XII.2009; L. Hendrich leg., bottle traps, kitchen strainer; 25 sex indet., CLH, ZSM • Perth, Success, Beeliar Recreation Park (WA 1/15); 32°08′S 115°50′E; alt. 19 m; 21–31.X.2015; L. Hendrich leg., shallow peaty puddle; 14 sex indet. and 20 larvae (LA III), ZSM • Perth, Success, Beeliar Recreational Park (WA 2/15); 32°08′S, 115°50′E; alt. 21 m; 21–31.X.2015; L. Hendrich leg., Paperbark Swamp; 10 sex indet., CLH, ZSM.

Distribution. South-western Australia. Coastal plains and swamps south of a line from Gingin north of Perth to Albany in the southeast (Fig. 2).

Identification. Differential diagnosis of Australian *Rhantus*, modified after Balke et al. (2000):

Rhantus simulans: Always larger than *R. suturalis*. Body length minus head 12.8–13.5 mm; pronotum with medial patch strongly expanded laterally (Fig. 1A); median lobe in lateral view broader (Fig. 1C).

Rhantus suturalis: Always smaller than *R. simulans*. Body length minus head 9.3–12.2 mm; pronotum with medial patch oval, not strongly expanded laterally (Fig.1B); median lobe in lateral view slender (Fig. 1D).

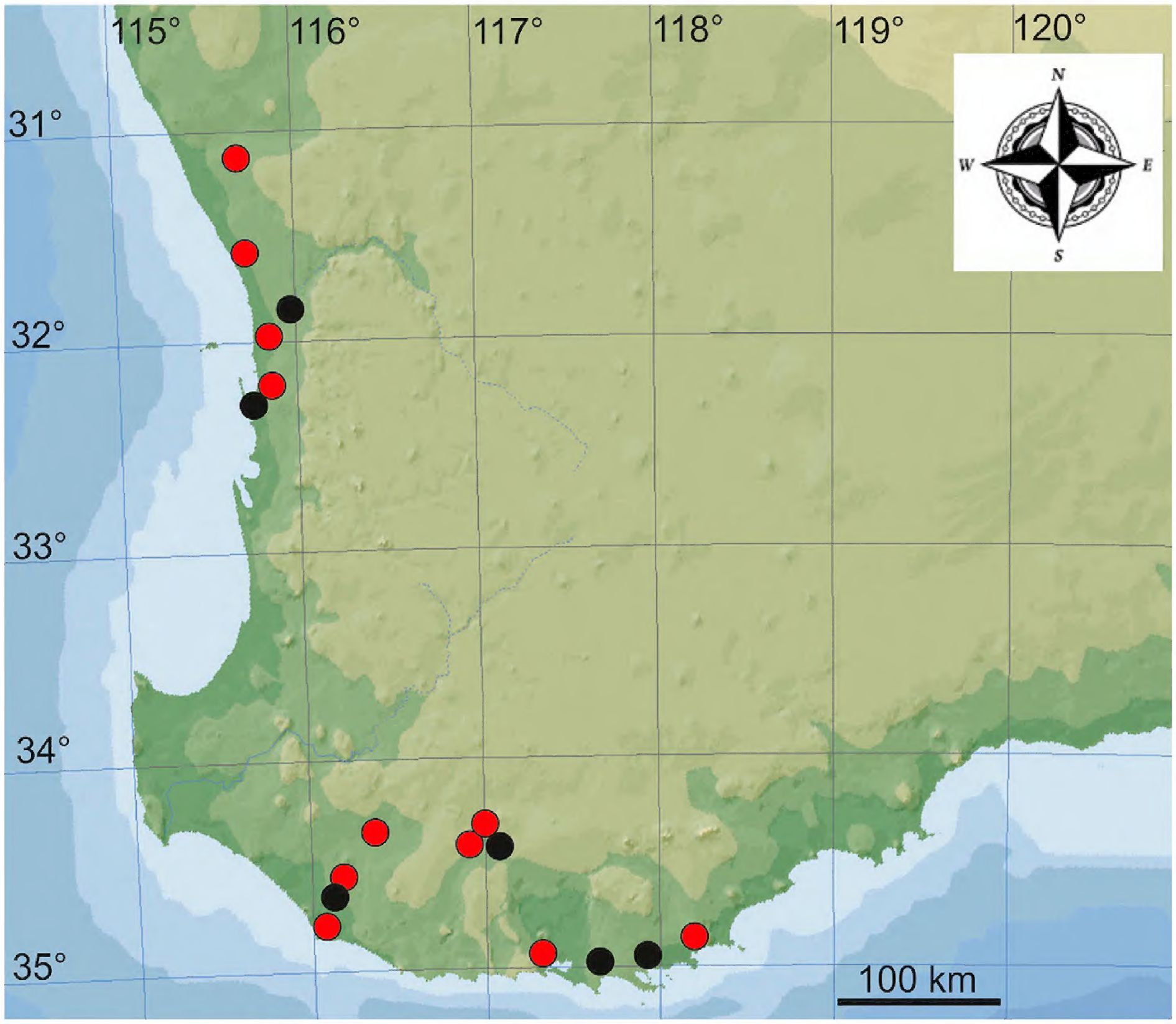

Figure 2. Distribution of *R. simulans* in south-western Australia. Black dots = published records, red dots = new records.

Discussion

Both Australian species of *Rhantus* are lentic. The common and widespread *R. suturalis* inhabits a large variety of standing waters such as flooded meadows, farm dams, ditches, and peatlands, and it is often one of the first dytiscids colonizing a newly formed body of water (Balke et al. 2009).

In contrast, for the successful development of larger populations, *R. simulans* (Fig. 3B) always requires the presence of swamp forests (Fig. 3A, E), dominated by swamp paperbark trees (*Melaleuca rhaphiophylla* Schauer), which also provide enough water in the dry, summer months to allow adults to survive. It seems that the larvae prefer to develop in ephemeral pools and puddles that are dry in summer (Fig. 3C), whereas the adults can also be found in permanent waters, which are often in forests or on the edge of swamp forests. The newly hatched adults remain between fallen leaves and rotting sedges in the residual water (Fig. 3D) of the slowly drying breeding waters (Fig. 3F) or migrate to more permanent waters nearby (Fig. 3A, E). They have also been caught on the banks of streams and lakes with thick sedges (e.g., Byenup Lagoon). Larvae of the 3rd instar could be detected in the Perth area until October, and further south near Northcliffe until January. The adults were collected from September to January. *Rhantus simulans* is almost always syntopic with the other Australian species of the genus, *R. suturalis*.

Rhantus simulans is an indicator species for intact wetland fauna. The presence of *R. simulans* always indicates occurrence of other conservation-relevant, endemic diving beetles in south-western Australia such as *Antiporus hollingsworthi* Watts, 1997, *A. mcraeae* Watts & Pinder, 2000, *Brancuporus gottwaldi* (Hendrich, 2001), *Exocelina atra* (Sharp, 1882), *Gibbidessus* ssp., *Paroster pallescens* Sharp, 1882, *Spencerhydrus pulchellus* Sharp, 1882, *Sternopriscus eikei* Hendrich & Watts, 2007, *S. minimus* Lea, 1898 and *S. storeyi* Hendrich & Watts, 2004 (Table 1).

Acknowledgements

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Figure 3. Habitat of *Rhantus simulans*. **A.** Beeliar Reserve, Success, Perth, eutrophic permanent paperbark swamp, with mats of floating vegetation, only adults. **B.** *Rhantus simulans*, living specimen in photo tray. **C.** Shallow, exposed and ephemeral puddle near location A, lots of newly hatched adults and instar III larvae. **D.** Almost dried pool near location A, lots of newly hatched adults in very shallow water, deep among rotten debris and floating roots of emergent vegetation. **E.** *Melaleuca* peatland swamp with sedges, 11 km south of Northcliffe, only adults. **F.** Exposed, shallow pool, 20 km south of Northcliffe, without any vegetation but rich in rotten leaves and twigs.

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Authors' Contributions

LH provided most of the specimens. LH and MB produced the photographs of morphological structures, and both authors wrote the manuscript.

Table 1. Diving beetles associated with *Rhantus simulans* in south-western Australia. A = Australia wide; E = Endemic to south-western Australia.

Associated diving beetle fauna	11 km south of Northcliffe	Marbelup Brook west of Albany	15 km south of Northcliffe	Road to Quinniup	Beeliar, Paperbark swamps	Beeliar, ephemeral puddles	Gingin wetland	Byenup Lagoon	Distribution in Australia
Family Dytiscidae									
Allodessus bistrigatus (Clark, 1862)				X					A
Antiporus hollingsworthi Watts, 1997									E
Antiporus occidentalis Hawlitschek, Porch, Hendrich & Balke, 2011								X	E
Antiporus mcraeae Watts & Pinder, 2000			X						E
Brancuporus gottwaldi (Hendrich, 2001)			X						E
Cybister tripunctatus ssp. *temnenkii* Aubé, 1838					X				A
Exocelina atra (Sharp, 1882)			X			X		X	E
Gibbidessus davidi Hendrich,Watts & Balke, 2020	X					X			E
Gibbidessus rottnestensis Hendrich, Watts & Balke, 2020			X			X			E
Gibbidessus pictipes (Lea, 1899)								X	E
Hyphydrus elegans (Montrouzier, 1860)	X						X		A
Lancetes lanceolatus (Clark, 1863)	X							X	A
Limbodessus inornatus (Sharp, 1882)	X	X	X	X	X	X	X	X	A
Limbodessus shuckardii (Sharp, 1882)			X				X		A
Megaporus howitti (Clark, 1862)								X	A
Megaporus solidus (Sharp, 1882)					X			X	E
Necterosoma darwinii (Babington, 1841)	X	X	X	X				X	E
Onychohydrus scutellaris (Germar, 1848)					X			X	A
Paroster pallescens Sharp, 1882						X			E
Platynectes aenescens (Sharp, 1882)			X					X	E
Platynectes brownei Gueorguiev, 1972			X						E
Platynectes ocularis Lea, 1895									E
Rhantus suturalis (Macleay, 1825)	X		X	X	X	X		X	A
Spencerhydrus pulchellus Sharp, 1882					X			X	E
Sternopriscus browni Sharp, 1882	X	X	X		X			X	E
Sternopriscus eikei Hendrich & Watts, 2007			X						E
Sternopriscus marginatus Watts, 1978		X		X					E
Sternopriscus minimus Lea, 1899			X					X	E
Sternopriscus multimaculatus (Clark, 1862)	X								A
Sternopriscus storeyi Hendrich & Watts, 2004	X							X	E
Sternopriscus wattsi Pederzani, 1999	X								E
31 species	10	4	13	5	7	7	3	15	

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